

**Effects of New Zealand Mud Snail  
(*Potamopyrgus antipodarum*) on Benthic  
Macroinvertebrate Food Sources of  
Salmonids in Lower Putah Creek**

**Richard Anthony Marovich**

## **Public Comments**

No public comments were received for this proposal.

# Technical Synthesis Panel Review

## Proposal Title

#0228: Effects of New Zealand Mud Snail (*Potamopyrgus antipodarum*) on Benthic Macroinvertebrate Food Sources of Salmonids in Lower Putah Creek

Final Panel Rating
inadequate

## Technical Synthesis Panel (Primary) Review

### TSP Primary Reviewer's Evaluation Summary And Rating:

Invasion by mud snails has the potential to impact many of CalFed's recovery goals, especially recovery of chinook salmon. Hence it is essential to document the impact of this invader. It appears that this study will be coordinated with other studies, particularly on feeding of pikeminnow; this adds value to the project, although it is not clear how this study has been designed. Two assumptions are critical to this aspect of the proposal: (1) That NZ mud snails are indigestible to salmonids. (2) That pikeminnows eat the same foods as Chinook smolts. Neither assumption is verified by reference to published literature. This research provides a unique opportunity to study a system as a species is invading; it is unfortunate that a more complete study of more aspects of the ecosystem is not being proposed. It is particularly unfortunate that only numbers of invertebrates are being counted. The results of this study would be much more valuable if secondary productivity were determined. Published length-mass relationships could be used to determine biomass changes over time, which is what is needed to measure secondary production. Simply studying the numbers of individuals is not an appropriate way to assess impact of this invader on an ecosystem! In addition, this study will provide little information on the mechanisms of invasion; this is a

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serious shortcoming that limits its value. The way the hypotheses are structured is overly simplistic. Scientific hypotheses should be explanatory; not simple statements of statistical tests to be conducted. The conceptual models may be visually appealing, but they do not clearly convey the concepts. Choice of sites is very vague. Given the knowledge of the ecosystem, some likely sites should have been indicated. The assumption is that differences among sites are a result of mud snail biomass; yet there may be underlying differences resulting from other factors. This is not considered. It is not clear why Davis is paid at two different hourly rates (sometimes \$80 and sometimes \$25). The budget for this study seems excessive. Production of peer-reviewed articles appears to be the responsibility of Bergendorf; yet his salary or release of his time from USFWS is not indicated in the proposal. It is of considerable concern that the person responsible for publication of the findings of this study is not a part of the proposal.

### **Additional Comments:**

External reviewers rated this proposal as very good and fair. Both reviewers recognized the importance of the topic. They differed in their assessment of the adequacy of the research proposed. The most positive review felt the experimental design was feasible, but expressed concern about the significance of this stream as chinook rearing habitat, about the lack of detail in site selection, the absence of procedures for decontaminating researchers as they move between sites, and the fact that the results of this project are raw data that will be given to another person who is not funded by or included in this proposal. The second reviewer pointed out serious deficiencies in the proposal that were not recognized by the first reviewer. The major deficiencies are that the study is correlational and will not elucidate the mechanisms through which the mud snail will displace native invertebrates, the fact that the study is being done on a single stream, the correlational nature of the study which does not recognize that differences among sites could be a result of natural gradients in conditions and not simply the presence or absence of mud snails, and the very limited

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sampling of fish diets that were proposed. The opportunities for understanding the mechanism of invasion of this species offered by this system are great; these opportunities have not been well thought out by the investigators.

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## Technical Synthesis Panel (Discussion) Review

### TSP Observations, Findings And Recommendations:

Effects of New Zealand Mud Snail (*Potamopyrgus antipodarum*) on Benthic Macroinvertebrate Food Sources of Salmonids in Lower Putah Creek

NZMS is a very important organism to study. It could have very important effects on the success of the salmon restoration program, and the panel concluded that a study of this invasion has great potential to contribute to addressing the NZMS problem, if it were designed well. However, this proposal was not well designed.

Only the number of invertebrates would be counted and not secondary productivity. The proposal would have been much stronger if secondary productivity had been measured. The panel had concerns about the pikeminnow foraging study, which was not directly funded by this proposal. The proposal rests on the assumption that pikeminnow and Chinook smolts feed on the same items and would respond similarly to the presence of NZMS. This assumption was not supported by data or by literature citation.

The proposed work includes very little investigation of the invasion mechanism. The conceptual model in the proposal poorly conveyed relevant concepts. Too few sites and streams would be studied. The study rests on correlations, not mechanisms, and the assumption that any differences between sites are a consequence of differences in levels of NZMS infestation cannot be supported.

### Technical Synthesis Panel Review

The panel had substantive concerns about the budget. It seemed high for the work proposed, and the person responsible for analyzing the data and for producing the publications resulting from this work would not be funded through the proposal, and there was no evidence of agency approval for this participation. The panel was concerned that this study would not result in a peer-reviewed publication.

Rating: inadequate

# Technical Review #1

proposal title: Effects of New Zealand Mud Snail (*Potamopyrgus antipodarum*) on Benthic Macroinvertebrate Food Sources of Salmonids in Lower Putah Creek

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	<p>The goal of this study is to document the spread of the NZ mud snail within Putah Creek that drains into the Bay Delta. This invasive species has recently been discovered and has shown early signs that it can achieve exceptionally high densities and spread widely through both natural dispersal and on the feet of fishermen. It has the potential to drastically alter the food base for endangered salmonids. However, the effects of this species on the stream food webs is not at all understood for this system.</p> <p>The hypotheses described are somewhat weak and the investigators will use correlational data to assess them.</p>
Rating	good

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

Comments	<p>The study builds on the existing knowledge about the effects of this invasive species on native food webs. However the conceptual model is somewhat rudimentary and does not attempt to elucidate the mechanisms</p>
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## Technical Review #1

	through which the mud snail will displace native invertebrates.
<b>Rating</b>	good

## Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

<b>Comments</b>	<p>The approach is not very well designed for meeting the objectives of the project. The approach will depend mostly on correlational studies to quantify the effects of the mud snail on the native invertebrates. For the size of the requested budget, I am surprised that the investigators will work only on Putah Creek. Given the ability of this species to spread elsewhere so fast, why are neighboring streams not also being monitored? To the investigators credit, this study will capitalize on the fact that the snail has recently invaded and that its spread and impact can be assessed in detail. However, more effort should be placed on reference systems to assess the variation in communities from non-invaded streams, and possibly detect future invasions by this species.</p> <p>If the investigators are interested in understanding more about the mechanisms through which the mud snail displaces natives, they should use more experimental approaches. The correlational study will tell them nothing about mechanisms.</p> <p>There is no justification for such little effort being applied to the fish diet studies. More than 10-20 diets from 2 sampling periods will be required to assess the effects on fish. How will reference systems be used for the diet study?</p>
<b>Rating</b>	fair

## Technical Review #1

### Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success?  
Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	The study as described is entirely feasible and will be successful in terms of achieving the stated goals of the study. However, as stated above, the hypotheses are weak and the goals are not very ambitious.
Rating	good

### Monitoring

If applicable, is monitoring appropriately designed (pre–post comparisons; treatment–control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	The investigators are capitalizing on the fact that this recent invasion to learn more about the ecology and impacts of this species. However, because the study focusses on a single site (Putah Creek) it is a fairly weak design. Why are more streams not going to be monitored as well? As stated above, the effort to be applied towards monitoring effects on fishes is entirely inadequate. Are there size-dependent effects on the fishes? Are there seasonal differences?
Rating	fair

### Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	The most valuable product from this study will be the capturing of data describing the effects of mud snails on the native communities - early in the invasion history. Apparently these data will be written into a peer-reviewed paper by
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## Technical Review #1

	the USFWS. There is little information provided to describe how these data will be made available to the broader scientific community.
Rating	good

## Additional Comments

### Comments

## Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	The investigators have extensive experience monitoring the invertebrates of streams in this region. However, they have limited experience in the full range of scientific activities (e.g., publishing, modeling, attending scientific conferences). The research team would be much stronger if it had more explicit ties to either academic or agency ecology groups. Although it is apparent that they have some ties to both of these other groups, it is difficult to assess how functional these collaborations are.
Rating	fair

## Budget

Is the budget reasonable and adequate for the work proposed?

Comments	The budget is extremely excessive for the work that will be accomplished. For a third this amount, CALFED could achieve the same results (and probably more) by funding a thesis project by a graduate student from a nearby university. The rate of 80\$/hour to check, clean, etc. benthic traps is absurd! This rate MIGHT
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### Technical Review #1

	<p>be more appropriate to pay a scientist a two weeks to write the results into a peer-reviewed paper.</p> <p>Given the spatial coverage of this project (i.e., one creek), the level of integration that will be achieved (a few simple metrics of community composition and biomass), lack of educational investment, and the richness of products, a more appropriate project should be funded for less than 100K total.</p>
<b>Rating</b>	poor

## Overall

Provide a brief explanation of your summary rating.

<b>Comments</b>	<p>This strength of this project is to capitalize on the early discovery of the invasive mud snail to document its effects on the invertebrate communities in Putah Cr. Correlational studies will provide data to evaluate its rate of spread and growth during the first years of its invasion.</p> <p>The project does not have a strong conceptual basis and does not provide any planning for understanding the mechanisms through which the invasive species will impact native communities. The opportunity for this is enormous but has not been thought-out by the investigators. If this is designed as a monitoring study, more creeks in the area should be included in the study to both account for background dynamics independent of the invasive snail, and to discover new invasions of this species in other systems.</p> <p>There is no concrete justification for the extent of the budget for this project.</p>
<b>Rating</b>	fair

# Technical Review #2

proposal title: Effects of New Zealand Mud Snail (*Potamopyrgus antipodarum*) on Benthic Macroinvertebrate Food Sources of Salmonids in Lower Putah Creek

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	Invasive species are a timely and important topic. Given that the New Zealand Mud Snail (NZMS) has recently (late 2003) invaded the lower Putah Creek, an important salmonid habitat, this project is certainly timely and important. I would even suggest a start date sooner than 2006-01-01, if possible. The overall goal of this project is to determine the potential impact of the invasive New Zealand Mud Snail on the benthic macroinvertebrate food sources of salmonids in the lower Putah Creek. Research objectives are to monitor movement of the snails, monitor changes in the biomass of snails, and to observe changes in the native invertebrate community. These objectives will be addressed through a series of well-defined hypotheses.
Rating	excellent

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

Comments	The authors have developed their testable hypotheses as a series of alternative conceptual models. In addition, they have developed a model for integrating
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## Technical Review #2

	a series of other projects that are either on-going or are completed. It is clear that this project will contribute to the bigger picture. However, the authors could have offered additional justification for this project by providing information concerning the relative importance of lower Putah Creek as Chinook salmon rearing habitat.
Rating	very good

## Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	<p>The authors have a well-defined and feasible experimental design that will meet their objectives. However, the selection and size of the sites and therefore the three "sections" are not described in adequate detail. This project will add to the base of knowledge concerning the impacts on ecosystems and modes and speed of spread of the NZMS in particular, and invasive aquatic snails in general. The methodology and approaches, while not novel, are relatively new and this project will provide additional validation of the gravel basket and photo brick methods in monitoring an invasive species. One concern I have is that the authors make no mention of decontamination of their equipment between visitations of sites to prevent themselves from becoming vectors for NZMS. It is unclear whether the information will ultimately be useful to decision makers; the outputs of this particular project will primarily be "raw" data and the authors have not outlined how decision makers might use the data once it is analyzed by Bergendorf (see Figure 6).</p>
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## Technical Review #2

<b>Rating</b>	good
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### Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success?  
Is the scale of the project consistent with the objectives and within the grasp of authors?

<b>Comments</b>	The approach is documented in detail and is technically feasible. These authors have developed the techniques themselves and therefore the likelihood of success is high. Possible problems include: extreme high waters, denial of access to monitoring sites (authors do not describe access points), or if NZMS have invaded all sites before project begins.
<b>Rating</b>	excellent

### Monitoring

If applicable, is monitoring appropriately designed (pre–post comparisons; treatment–control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

<b>Comments</b>	The monitoring plans for NZMS and other invertebrates have been appropriately designed. The authors will select areas of the lower Putah that have been invaded (post) and those that have yet to be invaded (pre) but are likely to be invaded during the study. Would monitoring some sites in another creek provide a type of control? This project will produce "raw" data only which will be statistically analyzed by D. Bergendorf, USFWS, and integrated with fish diet studies. It is not clear why statistical analysis and participation of Bergendorf was not incorporated into the proposed project.
<b>Rating</b>	very good

## Technical Review #2

### Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	Project products will include species lists, photo inventory of species, key to species, creek physical data including pH, temperature and velocity, and photos and counts from bricks. These data will be analyzed and combined with a study on pikeminnow diets for one or more interpretive journal articles. Although not mentioned, products I would expect, based on the authors' CVs, include presentations to local interest groups including fly fisher groups. The authors also do not mention contributions to the NZMS database maintained by Montana State University.
Rating	very good

### Additional Comments

Comments
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### Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	Based on the authors' past performances, as presented in their CVs, they are highly qualified to efficiently and effectively implement the proposed project. It is not clear, however, how Lindstrom and Navicky will contribute to the project. It is also not clear if the necessary infrastructure is available: trucks, shop to build samplers, computers, camera, etc.
Rating	very good

## Technical Review #2

### Budget

Is the budget reasonable and adequate for the work proposed?

Comments	The budget is primarily salary and a small amount for travel and supplies. It appears reasonable and adequate for the work proposed. No benefits, overhead, office supplies, computer supplies, printing, etc. are requested. No salary or supplies are requested for Bergendorf to complete the statistical analyses and final publications.
Rating	very good

### Overall

Provide a brief explanation of your summary rating.

Comments	This is a very good proposal that will result in some very interesting data. My only concerns are the relative importance of lower Putah creek in the overall recovery of Chinook salmon, and whether the raw data will actually be incorporated into usable documents; no letter of support concerning Bergendorf is provided by USFWS. These deficiencies can be addressed.
Rating	very good

